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ABSTRACT

Advanced automation is significantly affecting American society and the individual. To understand the extent of this impact, an understanding of the country's service economy is necessary. The United States made the transition from a goods- to service-based economy shortly after World War II. In 1982, services generated 67% of the Gross National Product. Automation has been a significant element of this society, contributing to major transformations in traditional industries, the creation of new industries, and changes in the workforce and the home. Projections on occupational opportunity to the year 2000 indicate that while automation and technology will effect the greatest changes at the higher levels of the work force, in jobs requiring college degrees, there will also be major increases in opportunities at the lower job skills level. As of yet, forecasts have overlooked impact on the middle mass of society, which may provide a better barometer of social change than either the "haves" or "have nots." Numerous issues remain to be addressed as society moves toward the next century, among them how to respond to: the declining need for workers, reduction of the work week, women as primary breadwinners, an aging population, single households, and membership in a global community. (LP)

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AUTOMATION: AN ILLUSTRATION OF SOCIAL CHANGE

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AUTOMATION: AN ILLUSTRATION OF SOCIAL CHANGE

Introduction

According to Webster's New World Dictionary, "Automation" is defined as

> 1. In manufacturing, a system or method in which many or all processes of production, movement, and inspection of parts and materials are automatically performed or controlled by self-operating machinery, electronic devices, etc. 2. Any system or method resembling this in using self-operating equipment, electronic devices, etc. to replace human beings in doing routine or repetitive work.

While that definition still holds true today, the applications of automation are becoming increasingly varied and complex due to the computer. The computer, because of its ability to collect, store, retrieve, and analyze increasing amounts of sophisticated information has, in effect, revolutionized automation and has been the primary contributor to advancing our information/service economy. To give some idea of just how far the computer has come--the number of computers increased from 0 to 10,000 between 1946 and 1960; from 10,000 to 10 million between 1960 and 1980. The new advanced automation, frequently referred to as "programmable automation" and/or "computerized automation", is computer-driven. This discussion focuses on the influence of advanced automation on the individual and society within the context of our expanding service economy-information society.

Service Economy - Information Society

To begin looking at the impact of automation on the individual and society, an understanding of the service economy is needed. For some time there has been acknowledgment that the Nation has progressed from a product-based economy to a service-based economy. In fact, the economy of the United States has been predominantly service-based for nearly 40 years.

Not since World War II has the goods producing sector come close to providing as much as 50% of the Nation's employment. Ironically, the same factor which caused the dominance of the goods producing sector over agriculture in the 1920's is also the primary factor contributing to the expansion of the service sector over manufacturing. That factor is automation.

As to the composition of the two sectors, each is comprised of four major areas of activity.[1] The goods producing sector encompasses (1) agriculture, forestry, fisheries; (2) mining; (3) manufacturing; and (4) construction. While the service producing sector encompassees (1) distribution; (2) general business; (3) consumer; and (4) community. A further breakdown is provided in Figure 1.

As the goods producing workforce has been shrinking, the service workforce has been expanding. The decline of output and employment in the goods producing sector and their increase in the services producing sector between 1959 and 1981 are depicted in Figure 2.[2] In 1982, services generated 67% of the Gross National Product, and service jobs were held by seven out of ten Americans. However, this does not mean to imply that U.S. manufacturing will be eliminated or that the demand for manufactured goods is declining. Not so!

The change to a service-producing economy is an inevitable progression in our economic development. As an economy evolves, the workforce naturally shifts from one segment to another. Agriculture did not die as its workforce shifted to manufacturing; manufacturing will not die as its workforce moves to services. The manufacturing economy enveloped the old agricultural economy and transformed it. Now services are having a similar

Figure 1

The Two Sectors of the Economy

Goods Producing Sector	Services Producing Sector
•Agriculture, forestry, fisheries •Mining •Manufacturing -lumber, wood products -primary metals -fabricated metals products -machinery -electrical and electronic equipment -motor vehicles -instruments and related products -food, kindred products -apparel, related products -chemicals, allied products -rubber, misc. rubber products •Construction	•Distribution services -transportation, utilities -trucking, warehousing -air transport -telephone, telegraph -electric, gas, sanitary services -wholesale trade -retail trade •General business services -finance, insurance -banking -business services -legal services -misc. professional services •Consumer services -real estate -passenger transit -repair services, auto, other -personal domestic -social services, membership organizations -radio, television -movies -amusement, recreation -hotels •Community services -health services -educational services -government, government enterprises

Figure 2

Percent Distribution of Output and Employment* Between the Goods and Services Producing Sectors, Selected Years, 1959-81

	1959	1969	1973	1979	1981
Output[1]					
Goods-producing	41.4	40.0	39.6	36.7	35.4
Service-producing	58.6	60.0	60.4	63.3	64.6
Employment[2]					
Goods-producing sector	38.3	34.6	32.4	29.5	28.0
Service-producing sector	61.7	65.4	67.6	70.5	72.0

*nonagricultural
[1]Bureau of Economic Analysis, U.S. Department of Commerce
[2]Bureau of Labor Statistics, U.S. Department of Labor

effect on manufacturing, which is being transformed by the new electronic information processing technologies. Demand for goods is not shrinking, only labor and materials input is. In a manufacturing economy, specialized firms end up supplying services more cheaply and more efficiently than the manufacturers themselves can. As the economy has evolved, services have become more important.

As to what might be expected in the future, within the first decade of the twenty-first century, only five to ten percent of the workforce will still hold manufacturing jobs, a percentage comparable to that engaged in agriculture today. Between now and the turn of the century we can still expect a loss of five to seven million manufacturing jobs--a job loss 20 times higher than today in the automobile industry.[3] Regardless, the change to a service economy does not indicate that the economic power of the United States is in decline. Quite the contrary. A service-driven economy signals the most advanced stage of economic development. Its wealth producing forces are no longer natural resources, but are its immaterial resources, namely intellectual and organizational skills. This is where the United States is.

In the United States, goods and services are interdependent and mutually supportive. As a manufacturing business expands, related services, such as transportation, communication, management, etc., tend to expand disproportionately. As a business grows and becomes more complex, it requires a far larger service element. In effect a synergy is at work--goods are needed to provide services; services are needed to produce goods.

Implicit to our service economy is the information society. Both have evolved hand-in-hand. Like the service economy evolved from a goods producing economy, the information society has evolved from an industrial society. In our information society, the applications of advarced automation have further expanded and diversified to an ever-broadening array of high technologies, the information technologies in particular. Again, the computer is at the core.

How are we being affected? It is no secret that we are inundated with information. The term "information overload" is one we are all familiar with. And the more information that becomes available to us, the more we generate. Central to the information explosion is automation. One form is electronic publishing, which provides on-line data bases to facilitate sorting through and selecting the information desired. Others providing access to even more information are teletext and videotext, already offering an electronic version of the encyclopedia through the videotext firm Compuserv. And more is yet to come!

To give you some examples of current information generation due in large part to automation:

> Between 6,000 and 7,000 scientific articles are written each day. Scientific and technical information now increases 13 percent per year, which means it doubles every 5.5 years.
> But the rate will soon jump to perhaps 40 percent per year because of new, more powerful information systems and an increasing population of scientists. That means that data will double every twenty months.
> By 1985 the volume of information will be somewhere between four and seven times what it was only a few years earlier.[4]

The Workforce

In this service economy-information society of ours, information is the product, service is the process and the provider. It was mentioned

earlier that 72% of American workers hold service jobs. The overwhelming majority, 60% of the U.S. workforce, is involved with some form of information handling--its creation, processing, and distribution. Almost all professional workers are information workers. For the information workers, i.e. knowledge workers, education is key. But when we look at projections of job growth to the 1990s provided by the U.S. Bureau of Labor Statistics (BLS) we get another picture.

If we break those projections into two categories: (1) job opportunities for college graduates and (2) job opportunities for noncollege graduates, BLS predictions reveal the greatest number of job opportunities will be for noncollege graduates. Figures 3 and 4 present the top fifteen in each category. As to which of these occupations will be affected by automation, it is difficult to determine. But for many, particularly in the noncollege group, occupations such as janitors, salesclerks, truck drivers, auto mechanics, it is highly unlikely. Surprisingly, it appears that those jobs most likely to be affected by automation are those in the college graduate category, which are primarily technical in nature.

To elaborate further, projections for noncollege graduates outnumbered those of college graduates by approximately 5 to 1. Further, of the college graduates' occupations most require advanced degrees, while those of the noncollege graduates require little, if any, training beyond high school. Looking at the number of high school graduates in 1980, which at 74% of the relevant age group has remained unchanged since the mid-1960s and the number of baccalaureate degree graduates, high school graduates outnumbered college graduates by approximately 3 to 1. See Figure 5. The

Figure 3

Job Opportunities for College Graduates

	Projected Job Growth By 1990
•Elementary School Teachers	251,000
•Accountants, Auditors	221,000
•Computer-System Analysts	139,000
•Electrical Engineers	115,000
•Computer Programmers	112,000
•Mechanical Engineers	62,000
•Aero-Astronautic Engineers	29,000
•Architects	26,000
•Psychologists	24,000
•Dietitians	17,000
•Physical Therapists	17,000
•Speech, Hearing Clinicians	16,000
•Economists	12,000
•Geologists	12,000
•Veterinarians	11,000
Total Opportunities	964,000

Figure 4

Job Opportunities for Non-College Graduates

	Projected Job Growth By 1990
•Secretaries	700,000
•Nurses' Aides, Orderlies	508,000
•Janitors	501,000
•Sales Clerks	479,000
•Cashiers	452,000
•Truck Drivers	415,000
•Fast-Food Service Workers	400,000
•General Office Clerks	377,000
•Kitchen Helpers	231,000
•Auto Mechanics	206,000
•Typists	187,000
•Carpenters	173,000
•Bookkeepers	167,000
•Guards Doorkeepers	153,000
•Stock Clerks	142,000
Total Opportunities	5,081,000

figures imply that by 1990 job opportunities for noncollege graduates will be more available, while those for college graduates will be more difficult to come by.

Computerized automation will continue to affect occupations, even newly created ones as technology continues to advance. The new society is

Figure 5

Comparison of Graduates of 1980
to
Available Jobs in 1990

	Number of Graduates 1980*	Available Jobs 1990**
High School Graduates	3,063,000	(5,081,000)
College Graduates		
baccalaureate	929,417	
masters	298,081	(964,000)
doctors	32,615	

*National Center for Education Statistics
**Bureau of Labor Statistics

making difficult demands. On the one hand it is demanding its citizens to cultivate their brain power, while on the other it is contributing to a growing need for minimal skills requiring little thinking. To succeed in our information society, knowledge and commensurate skills via educational opportunity and achievement are essential, yet a growing number of the Nation's population will not be prepared to respond. The information society is demanding adaptation to the accelerating rate of change that has become a major characteristic. The traditions and practices of the past no longer hold. It is demanding a reinterpretation of societal values in keeping with the social change that is occurring. This involves new interpretations of wealth, of work, and of the quality of life.

The Individual

More than ten years ago, a typology of life styles for the information society was developed by Donald Michael of the University of Michigan.[6] The typology classifies individuals into several categories based on those who are actively a part of the information society and those who are not,

either by choice or inability. It is also applicable when examining individual response to automation. Four classifications are given: (1) Acceptance, (2) Rejection, (3) Indifference, and (4) Inadequacy. Figure 6 explains each one.

Figure 6

Categories of Response
to the
Information Society

ACCEPTANCE (I) ⟷ INDIFFERENCE (III)

Those who accept, become skilled in, and make extensive use of the new information environment to pursue their individual and collective goals:

- will tend to be future oriented; open to a wide variety of intellectual inputs;
- their sources of reward and punishment may depend on traditional styles or derive from new role definitions of man.

Those "functionally" affluent through their own entrepreneurial or other skills and/or through subsidy able to remain indifferent to the demands of the new information environment may tend to be:

- unmotivated by commitment or ideology towards closer participation;
- undereducated in its potentials so as to be unresponsive to it or seek its use only where compatible with their specific desires and satisfactions;
- as consumption/play oriented, will measure public action only in terms of more immediate impacts on, or threats to, their security.

Those unable to use the new information environment because they are socially or culturally inadequate, i.e. as a result of inadequate education* and/or discrimination, will tend towards:

- values and life styles oriented towards those now considered conventional as to right/wrong, worthy/unworthy, etc;
- insulating themselves from information disturbing to such value systems;
- being ineffective in using the changing environment--and knowing it.

Those who reject the larger implications of the new information environment--including some who are occupationally skilled in the area:

- may be actively or passively alienated from the commitments of the larger society and tend to be idealogically separated from it;
- will live by different values and life styles and either be reclusive in their personal orientation or activity-engaged in "outward" social movements.

INADEQUACY (IV) ⟷ REJECTION (II)

*Inadequate education is here meant to include the education provided most people who will populate the next twenty years--an education that leaves them incompetent in analytic and synthetic cognitive skills, in interpersonal relationships, and in self-understanding. (Michael)

Category I--Acceptance consists of the knowledge workers, who are technologically literate and in control of the new information technology. They represent the information "haves". Category II--Rejection represents those who refuse to be part of the larger information society. It is their choice not to respond. Category III--Indifference is made up of those who do not feel they need to respond although they are able to, but do not do so until there is societal pressure to or until they view it as essential to their well being. School superintendents, corporate executives, university professors frequently fall into this category. Most of us fit this classification. Finally, Category IV--Inadequacy encompasses those who are unable to respond to the demand of the information society. The category includes displaced workers, unemployed youth, minorities, etc. They represent the information "have nots".

Another category, one Michael does not account for, applies to the masses functioning in the information society who are gainfully employed and are interacting with the information technologies in areas other than work, namely leisure and family life. This group might be classified as the Silent Majority, and are somewhere in between Acceptance and Indifference. They respond as consumers of the technology and use it for pleasure and other personal uses. This category represents the most rapidly growing group of respondents to the information society.

Social Stratification

In examining current employment and future forecasts, it appears that changes in the workforce will have dramatic implications for the Nation's social structure. With considerable certainty, projections are indicating one-fourth of laid-off U.S. automobile workers and one-third of laid-off

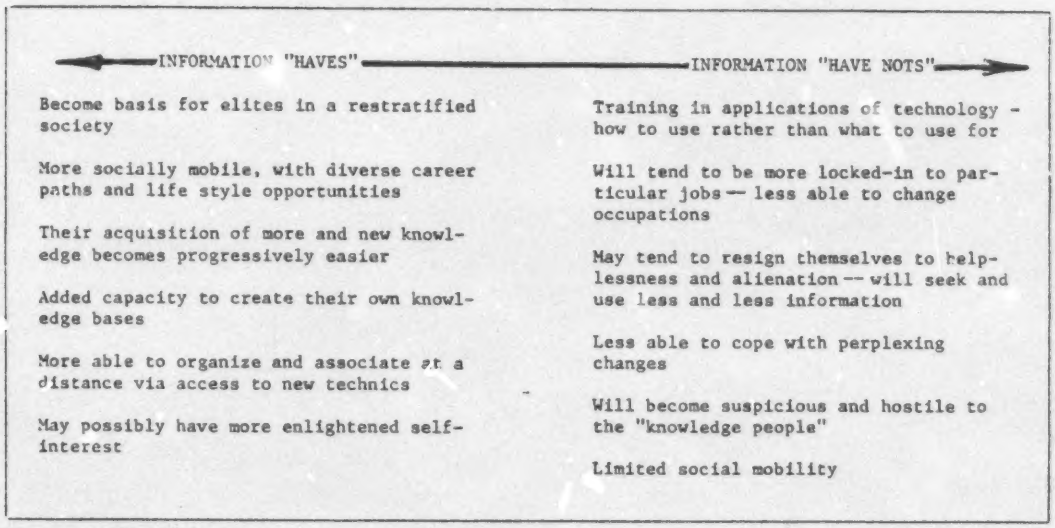
U.S. steel workers will never get their jobs back. As a result there is a growing group of chronic unemployed (the Inadequate). With education now a major political issue, there is vociferous acknowledgment that the traditional basics (reading, writing, and computation) are not enough. Learning expectations are too low. And if pupils are not performing academically in the lower grades, it is highly unlikely they will be able to catch up in the higher grades.

Based on the growing disparity between the information "haves" and "have nots", our society is being further stratified into the knowledge people, those who are able to adapt to the new technologies and do (the Acceptors and the Silent Majority); and those others who either choose not to or are unable to (the Rejectors, the Indifferent, and the Inadequate). Figure 7 reveals the implications of the information society for the "haves", those who possess the necessary education and skills to participate fully in the information society, and the "have nots", those who are denied full participation for various reasons.

Closer to the "have nots" than the "haves" is another group that can be referred to as the "Somewheres in the Middle". The "Somewheres" make up the largest segment of the service economy-information society. While the "Somewheres" may be like the "have nots" in most of the qualities identified, they will be significantly unlike them in one--they will <u>not</u> resign themselves to helplessness and alienation. Most likely they will be part of that <u>Silent Majority</u> enjoying the computer and other information technologies for pleasure, as well as using them increasingly in their every day lives, i.e. video games, household robots, computer shopping, etc.

Figure 7

Two Polarized Segments of the Information Society


INFORMATION "HAVES"
INFORMATION "HAVE NOTS"
Become basis for elites in a restratified society
More socially mobile, with diverse career paths and life style opportunities
Their acquisition of more and new knowledge becomes progressively easier
Added capacity to create their own knowledge bases
More able to organize and associate at a distance via access to new technics
May possibly have more enlightened self-interest
Training in applications of technology - how to use rather than what to use for
Will tend to be more locked-in to particular jobs — less able to change occupations
May tend to resign themselves to helplessness and alienation -- will seek and use less and less information
Less able to cope with perplexing changes
Will become suspicious and hostile to the "knowledge people"
Limited social mobility

Source: Michael

Automation Outside the Workplace

Because of our focused concern regarding the impact of automation on employment and the workplace, one dimension of its human aspects that also has significant implications but is given inadequate attention is its impact on the family. Automation is advancing most rapidly in home use. It is estimated that over 40% of all American households will have home computers by the end of this decade, and that 40% will have two-way videotext by the end of the century, less than 17 years away. (Television took only 16 years to exist in 90% of American households.) Then there are the household robots. One year ago it was predicted that we would not have home robots until the year 2000, now several are on the market, and if we add teaching robots which also have home uses, there are over a dozen.

Unfortunately as home use expands, the distinctions between the "haves" and the "have nots" also will expand.

Conclusions

Based on the preceding discussion, five conclusions can be drawn.

1. We are in a service economy-information society. Interpreting its evolution based on a goods producing, industrial society is inappropriate.

2. Automation is a major element of our service, information society. It is contributing to major transformation in traditional industries, as well as the creation of new ones. It is having a significant impact on the workforce, some segments much more than others. It is having increasing impact in the home.

3. There are many disparate projections on occupational opportunities to the year 2000. It appears that there will be major increases in opportunities at the lower job skills level. While those with college degrees will remain at the top, their jobs are most likely to be affected by automation and other technological advances.

4. There is a middle mass that has not been given adequate attention in contemplations on the impact of automation and adaptation to the information society. While speculations focus on the "haves" and the "have nots", the middle mass provides a better barometer for social change.

5. The impact of automation on the home and how it might relate to the workplace has not been adequately examined. We may have a lost generation of those unable to adapt, but we also have up and coming generations that have been exposed since early childhood.

Two difficult tasks will continue to face us as we move toward the twenty-first century: (1) adaptation to the rapid rate of change due in

large part to technological advances; and (2) the value change necessary to the information society. In that regard, numerous issues need to be addressed. Among them, how our society will respond to: the declining need for workers, reduction of the work week, elimination of waged labor, more women as primary breadwinners, an aging population, more people living alone (24% of U.S. households today), being part of a global community, lifelong learning, technological literacy, and innovation, creativity, entrepreneurship, to name a few.

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